

Vaillant affords more

innovations.

For the further development of the fuel cell heating system up to serial production, Vaillant is committed to the principle "quality before haste." And thus, you - as a Vaillant customer - will always be the first to benefit from our innovations. Because Vaillant consistently advocates the use of new technologies in order to combine the economic use of resources with high quality of life.

Thus, Vaillant still continues to work on systems equipped with the conventional technology of combined heat and power. Furthermore, jointly with Honda, Vaillant develops gas-operated microCHP systems, and with other partners, wall-hung CHP systems equipped with Stirling technology. Vaillant will very soon be able to offer the well-matched cost-saving and climate-friendly systems for one-family homes for testing. Please turn over!

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## MicroCHP

with Honda engine

The combined heat and power is not only an important contribution to meet the European climate protection targets. More, it will be the future of residential convenience in the one-family home.

The microCHP system developed by Vaillant is operated with a natural gas engine system produced by Honda. This engine system generates 1 kW electric power and 2.8 kW heat output via a generator.

With the simultaneous production of heat and electric power with only one appliance, the primary energy "natural gas" is optimally utilised. That makes you cash money for your household. In addition, in Germany the microCHP systems are subsidised by governmental investment grants as well as the CHP bonus for produced electricity which is guaranteed for a period of 10 years. And excess electric power is easy to sell!

## MicroCHP unit

with the Stirling engine

An extremely compact CHP solution is offered by Vaillant: the microCHP unit with Stirling technology: on the one hand, the wall-hung appliance equipped with a gas condensing unit which at the same time provides heat for heating and for the engine, and on the other hand the Stirling engine which is an almost maintenance-free heat engine with external combustion.

The microCHP unit equipped with the Stirling engine supplies electric energy and at the same time about 7 kW heat. We thus provide a lot of benefits for the one-family home: It is extremely space-saving and, as an option, it may be used as a combined appliance with integrated instantaneous production of DHW or in combination with an external hot water cylinder.

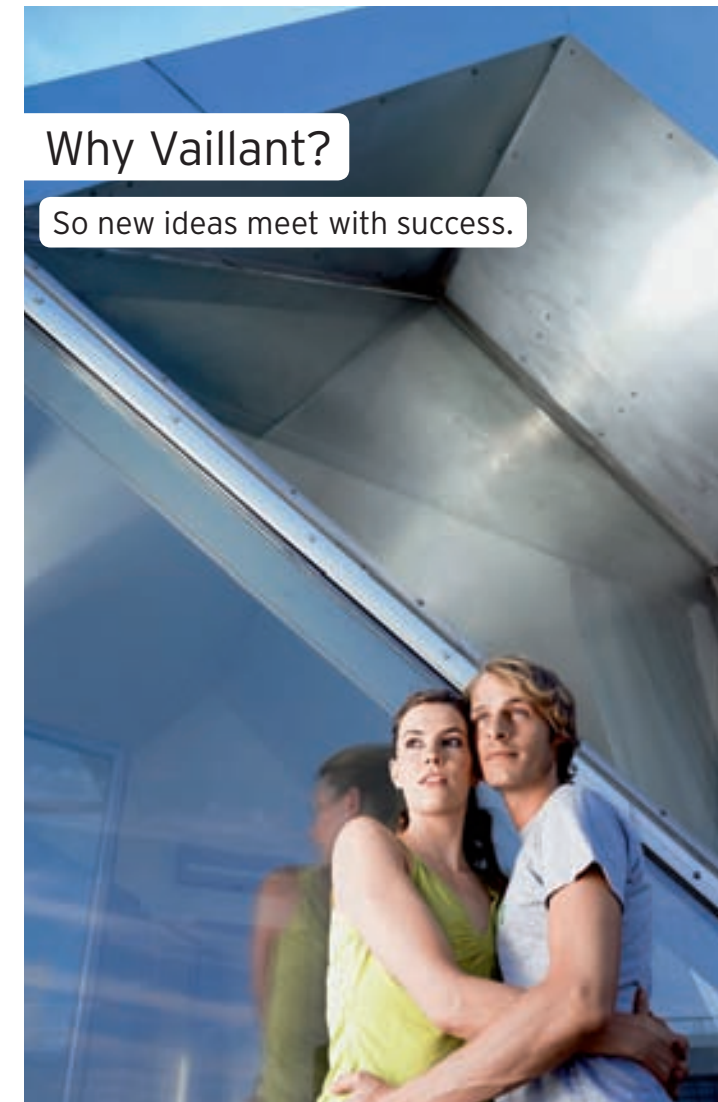
Vaillant develops the Stirling technology with an experienced team in order to ensure that you will be able within short to test the microCHP technology in your home.

For up-to-date information, please contact:  
[www.vaillant.de/Warum-Vaillant/Forschung-Entwicklung/](http://www.vaillant.de/Warum-Vaillant/Forschung-Entwicklung/)



## Why Vaillant?

So new ideas meet with success.



Vaillant Innovation: fuel cell heating appliance

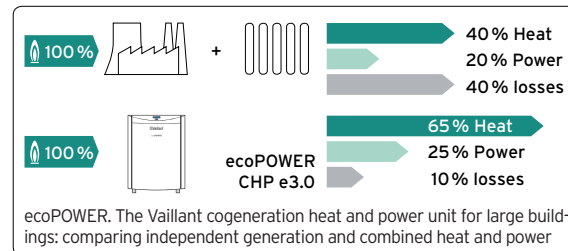
Because  Vaillant thinks ahead.

## The future

### of combined heat and power

Why just utilise energy once when manifold use is the option? With combined heat and power (CHP) you can generate electric power and heat at the time with one compact appliance installed in your own home - and thus not only reduce your energy bill but as well your carbon footprint, i.e. the CO<sub>2</sub> emissions.

Owing to this climate-friendly effect, the Federal Government intends to increase the share of electricity produced by combined heat and power to 25% till the year 2020. And Vaillant is quite willingly having its share in it. For 10 years now, we have been offering the ecoPOWER micro-cogeneration heat and power unit for private homes - thousands of European customers already benefit from this technology: CHP systems with modulating gas combustion represent today's efficient technology.



However, fuel cell technology stands for the future of innovative combined heat and power. Compared to the traditional individual generation of electric power and heat, these innovative systems consume up to 25% less primary energy. In addition, CO<sub>2</sub> emissions can thus be reduced by up to 50%. Here, with this technology, Vaillant is running extensive field tests.

170 years of age and still brand new:

## the fuel cell

The idea of the fuel cell emerged already in 1838, however, it was put into practice only in the 1960s: by NASA. Vaillant is striving to integrate this highly efficient technology in one-family homes.

The fuel cells convert chemical energy directly into electric energy using electrodes separated by electrolyte. The fuel cells are combined to form so-called stacks in order to provide the required output. Once the fuel cell heating appliance is connected to the natural gas mains, a reformer first converts natural gas into hydrogen-rich gas. Then, the gas reacts in the fuel cell stack with the oxygen contained in the air. Here, electricity and heat are produced in a silent "cold" combustion process.

Since 1999 Vaillant has been testing three different fuel cell technologies. Vaillant has gathered vast experience in over 400,000 operating hours with 60 systems: This experience resulted in a decision. The Vaillant focus is now on the most promising technology: the SOFC.

## Intelligent energy

### for one-family homes

The abbreviation SOFC stands for "Solid Oxide Fuel Cell", i.e. oxide ceramic fuel cell. The electrolyte consists of a solid ceramic material which conducts oxygen ions but is non-conductive for electrons. This is a high-temperature fuel cell providing high output and high efficiency using at the same time favourably priced materials.

At present, Vaillant is testing a SOFC heating appliance which offers a simple but solid and robust system structure and a start-stop function. This system is able to produce at the same time 2.0 kW of heat and 1.0 kW of electricity. Since the beginning of 2010, Vaillant has tested several prototypes in its labs and further developed them for the field test Callux.

The intelligent microCHP system which is equipped with fuel cells is environmental-friendly, highly efficient and extremely silent. It offers high heating and hot water convenience for one-family homes and at the same time significantly reduced energy bills.



Vaillant is responsible for the complete system development of the fuel cell heating appliance in cooperation with strong partners: Staxera GmbH develops and produces the stack modules. The Fraunhofer Institut für Keramische Technologien und Systeme (IKTS) (Institute for Ceramic Technologies and Systems) brings in its scientific competence in component development, in system simulation and testing.

At present Vaillant is involved in the project Callux ("calor" = heat, "lux" = light). In the scope of this field test, which is the biggest nationwide field test ever realised up to now, about 800 fuel cell heating appliances shall be tested over a period of 8 years in private homes. As one of the partners who jointly invest over 80 million Euro in this project, Vaillant makes available a considerable number of test systems.



Callux will be a milestone in the further development of the fuel cell heating appliance. As a matter of fact, after a successful conclusion of the field tests, systems which are ready to go into serial production will move into one-family homes. In yours as well.